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Contents

Nasca Sprang Tassels: Structure, Technique, and Order

Mary Frame

Among the wealth of ancient Peruvian textiles in museum collections, a few stand out as more enigmatic than the others. Their origin, their imagery, and their function are obscure, and even their structure may defy analysis. Imagining how they were made can be even more baffling. For textile researchers, they are irresistible objects for study and conjecture.

A certain kind of bell-shaped tassel has intrigued Peruvian specialists for many years (Fig. 1A). Photographs of the tassels have been published many times,[1] but the textual information is always scant, reflecting how little is known about them. During the course of thesis research, I assembled a large sample of these tassels from various museums and publications, categorized the range of variants on technical and stylistic grounds, and presented analyses of the nonwoven structures. As well, I surveyed the iconography and attempted to group and relate the images to those on ceramics and textiles of the same style.[2] This article will deal with the largest and seemingly standard category of tassels, particularly the complex structure and esoteric technique used in their manufacture. Although the fabric structure is one of the most complex found among ancient Peruvian fabrics, it is built through an orderly combination of familiar manipulations: thread pairings, intersections, rotations, reflections, and inversions.

General Description

An average tassel in the largest category might measure .32 × .22 meters and have in excess of seven hundred warp threads. The spinning and plying (Z-2S) of the alpaca yarn is fine and even and the fabric is densely worked on two interchanging layers of contrasting color. The major structure is a variant of oblique intertwining[3] and the fabric consists of two mirror-imaged pieces joined in the center by unworked warps. The tassel is constructed by folding across the unworked warps and sewing together the side selvedges. The terminal section, on either side of the fold, is compressed into a short neck by a few rows of oblique interlacing, and the unworked threads are covered with a separate layer of cross-knit looping. The remaining edge, opposite the cross-knit looping, is left open, with the two ends of the two-layered fabric simply lying one above the other. An unusual feature is the absolute reflective symmetry between the layered fabrics of each tassel face. Both structure and image are precisely reflected as a result of the sprang technique used in their manufacture.

Identical and nearly identical pairs of tassels (Fig. 2) occur and some pairs are still joined by a long, thin strap attached to the cross-knit looping.[4] Many single tassels have wear and tear or remnants of sewing in places that indicate they, too, were originally attached to a similar strap and so were probably paired as well. The collocation of joined parts suggests that the flaring parts hung, tassel-like, from the long cord which may have been wrapped many times around the head or even the waist. Their suspension makes it clear they were not used as containers because the opening falls downward, away from the attachment point. Raoul d'Harcourt called the tassels "*couvre-nuque*."[5] Although he does not explain why, he obviously felt they were worn on the head, hanging down over the nape of the neck. With the emphasis on elaborate turbans and headdresses in earlier Paracas and Nasca style mummy bundles, Harcourt may well be right.

The images on the tassels are difficult to decipher at first sight. The two colors of the interchanging layers, used for figure and outline, contrast sharply, and the color areas are narrow and equal in width which produces an overall, mazelike patterning. With no expanse of background space, the eye wavers between the

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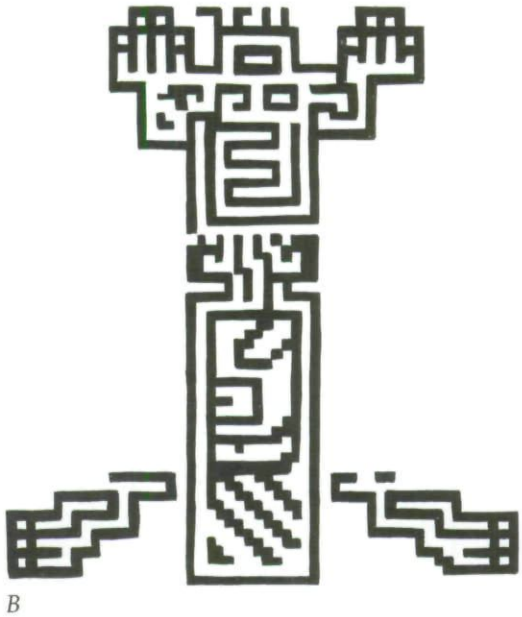

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Fig. 1. (A) Example of the most numerous and seemingly standard type of tassel; Museum of Mankind, 1914 7-31 51, courtesy of the Trustees of the British Museum
(B) The primary figure in (A) with the secondary motifs stripped away

positive and negative space. The constraints of the complex structure impose an angularity and modular format that further distorts the images.

Other barriers to recognizing figures on the tassels arise from the peculiarities of the style. Human and zoomorphic attributes are combined in creatures that are portrayed in a range of postures. Several viewpoints—profile, frontal, and dorsal—are sometimes combined. Secondary motifs of rays, hooks, and heads may surround and fill figures so that no recognizable silhouette emerges. Facial features may be given to forehead ornaments, mouth masks, and tongue attachments. Bodies may be abbreviated and body parts omitted or rearranged other than naturally.[6] Although the design panel as a whole has a geometric appearance, the figure(s) can usually be discerned by locating the appendages that terminate in squares, indicating nails or claws, and by locating eye squares (Fig. 1B). However, some abbreviated and disjointed figures with a plethora of secondary motifs remain elusive, even when appendages can be located (Fig. 2).

There is considerable variation in the layout of the design panel. Simpler profile figures can be repeated in a vertical column and the final repeat may be incomplete (Fig. 3). Very simple figures may repeat in two vertical columns. Alternations in orientation are used (Fig. 4), but not always. Elaborate images are usually frontal or dorsal, and they may take up the entire design panel, partially repeat themselves (Fig. 5), or be flanked by another image (Fig. 1).

The tassel bodies usually contrast yellow with shades of green, including blue-green, or red. Red and green also occur in combination. No combination clearly predominates and all colors appear as figure or outline. The cross-knit looping on the end of each tassel incorporates five or six colors, and the imagery overlaps with that on the tassel bodies.

Style Affiliation

Of the forty-five tassels located (fifteen pairs and fifteen single specimens), none is reported to have been found with a mummy or with other artifacts. Almost all the tassels have been unearthed by *huaquero* (grave looter) activity, so that even a general provenience is rare. One tassel in the Field Museum, Chicago, does come from A. L. Kroeber's 1925 and 1926 work at Cahuachi in the Nasca drainage of the South Coast.[7] The tassel is published with

Fig. 2. Pair of oblique intertwined sprang tassels joined by an incomplete woven cord; the figure in the design panel is not easily identified although appendages with three digits can be located near the bottom of the tassel and again near the top where the image begins a second repeat; The Textile Museum, Washington, D.C., 1977.35.1

an asterisk, indicating that either it was surface collected or that no information was recorded. The site provenience of Cahuachi, however, is specific. Tassels in the Museé de l'Homme are given a provenience of Nasca,[8] but the basis of the attribution is not given. Although provenience information is scarce, none contradicts a south coast locale which is supported by stylistic and iconographic affinities to textiles of secure south coast provenience.[9]

Because the tassels have no grave associations, placing them in a general cultural context relies on stylistic comparison to the ceramic sequence[10] and to other textiles that have been stylistically related to the ceramic sequence.[11] The style of the tassels shows a continuity with the late phases of the Nasca style, particularly in the emphasis on secondary motifs, such as rays and volutes, trophy heads,

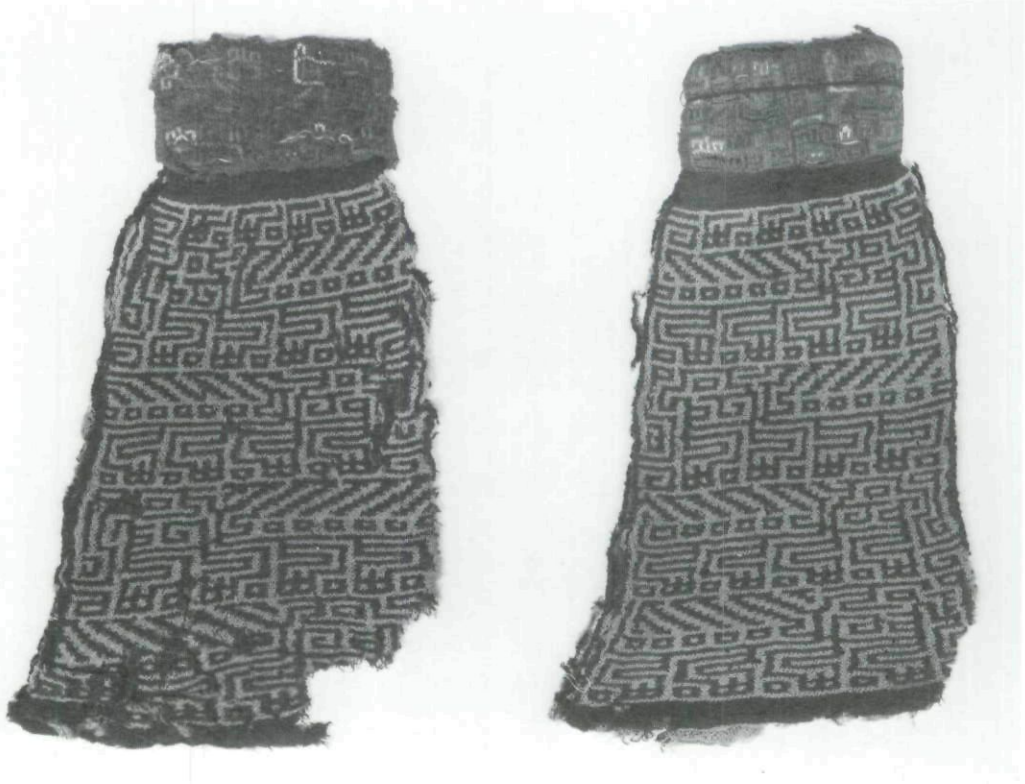

Fig. 3 The layout of the design panels takes various forms. Here, a horizontally aligned creature with human head, four (pairs?) of legs and a winglike element of oblique striations repeats in a vertical column with some alternations in the direction it faces; The Textile Museum, Washington, D.C., 91.5374, b

Fig. 4 The figure on this tassel is repeated five complete times in two vertical columns and is alternately left- and right-facing in each horizontal row; the figure, with its monkeylike tail, may relate to the "humped animal" that appears on ceramics; Museum of Mankind, 1828.6-14, courtesy of the Trustees of the British Museum

Fig. 5. One of a joined pair of tassels; a dorsal view of an elaborate standing figure with backward thrust head takes up the whole width of the design panel, but begins a second repeat near the top of the tassel; the figure wears an elaborate face mask with proliferous attachments; its upward-extending tongue ends in a trophy head and four-part volute; courtesy of Museum für Völkerkunde, Staatliche Museen Preussischer Kulturbesitz, Berlin, VA 65807

and extensions on the face and headdress ornaments that frequently engulf the rudimentary figures. Trends toward the elimination of background space and the reduction and unnatural placement of body parts gather momentum during the middle to late phases of the Nasca style.[12]

The Nasca heritage of the tassels is especially visible in technical aspects: the nonwoven structures of cross-knit looping and oblique intertwining can be found in fabrics from the beginning of the Nasca tradition.[13]

Some themes, like the being with the elaborate face-mask in Fig. 5, can be found on Nasca 6 and 7 ceramics.[14] The style of the proliferous face-mask, with its large laterals and extensions that encircle the eyes, is shared by the ceramic and textile examples. An elaborate tongue treatment, large forehead ornament, and the bodily contortion of a backward-thrust head are also shared. Another theme, a human figure carrying a feathered staff, appears upside-down on the tassel in Fig. 6 and also appears on several Nasca 7 ceramics (see, e.g., Lowie Museum of Anthropology, University of California, 4-8951).

Along with themes that can be found on Nasca 6 and 7 ceramics, there is also iconography imported from the highland Huari art of the Ayacucho area. A variety of zoomorphs that cannot easily be classified appear on the tassels and seem to relate broadly to what Menzel has called the humped animal (Fig. 4), the Ayacucho serpent (Fig. 1, top and bottom of design panel) and the stinger animal (Fig. 1, center of design panel).[15] As Huari influence becomes widely felt on the coast in Middle Horizon 1B. (ca. A.D. 650–700), which is the period of the final phase of the Nasca tradition, it is probable that many of the tassels belong in this time period. The fusion of highland imagery with the techniques and some stylistic trends of the coastal Nasca culture seems to indicate a gradual assimilation of the Nasca people who accepted the new highland images but continued, for a time, to treat them in their own way.

The tassels seem to be a South Coast specialty, arising out of traditional methods of making textiles during the Early Intermediate Period. The images on the tassels relate to those on ceramics from as early as Nasca 6 through to Nasca 9B in Middle Horizon 1B.

Technique and Structure

A technical description of the tassels needs to distinguish between the struc-

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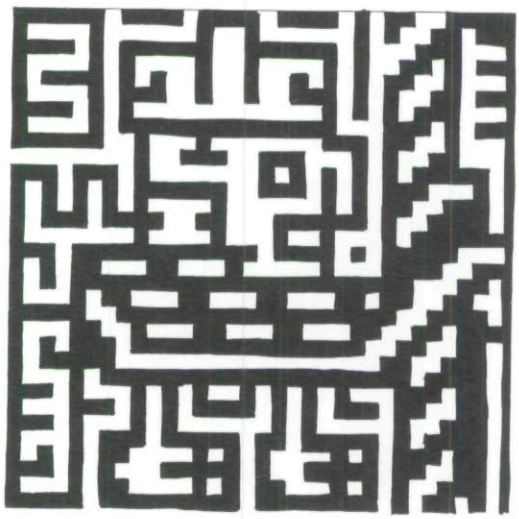

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Fig. 6. (A) One of a pair of tassels; a squat human figure that wears a tunic and carries a feathered staff is depicted upside down in the upper left quadrant of the tassel; the disjointed figure below is not easily recognizable, although two feet and an eye as well as another feathered staff can be picked out; courtesy of The Art Institute of Chicago, 1955.1793b
(B) Drawing of the human figure shown right side up

ture, or existing interworking of elements, and the technique, or manner in which the elements were handled during the construction process. Analyzing the structure is usually a straightforward matter, a laborious plotting of the courses of individual elements. Structures can be classified and broadly named, but complex variants, like those of the tassels, finally have to be diagrammed to accurately present the interrelationships of elements, layers, twists, and color junctures. Arriving at the technique used to make an ancient fabric is a more complicated matter because it is possible to create structures in more than one way. Once fabrics are finished, information on warping, tensioning, shedding, tools, and hand movements can be obscured or lost. However, some indication of the technique may remain in the cloth, particularly in the selvedges or in the terminal area. Unfinished examples can be very illuminating. Tracing the evolution of a specific technique and examining tools, tensioning devices, and warping methods of the wider tradition of fabric-making can be helpful in advancing an argument for the use of one technique over another. With ancient Peruvian fabrics, it is frequently necessary to explore all of these avenues to arrive at a convincing reconstruction of a technique.

The most intriguing aspect of the tassel technique is the reciprocal principle, which simultaneously produces two fabrics that are in exact mirror-image symmetry at opposite ends of the element set. An unfinished example (Fig. 7A) shows the two symmetrical halves of the fabric before it was constructed into a tassel. There are loops at the warp selvedges, indicating the warp is a continuous one, and the unworked warps in the center joining the two symmetrical halves indicate they were worked reciprocally. Like the childhood game of cat's cradle, single crossings made on a closed system result in two mirror-imaged crossings. In the tassels the oblique intertwined crossings were transmitted to opposite ends of the warp and densely packed, building up the fabric from the extremities toward the terminal area in the center. The two interchanging layers of fabric have the colors in inverted positions on the hidden face (Fig. 7A, B).

The technique is referred to as "sprang" in the recent literature, although it has previously gone by other names, such as double plaiting and twine-plaiting.[16] It is a technique of interworking a single set of undifferentiated elements that are stretched flat and fixed at both ends. The elements make crossings with each other when they intersect on oblique and/or spiral pathways. In addition to oblique intertwining, oblique interlacing and interlinking can be done in the sprang technique. A number of variations on each basic structure are present in the fabrics from ancient Peru.[17] The technique can be

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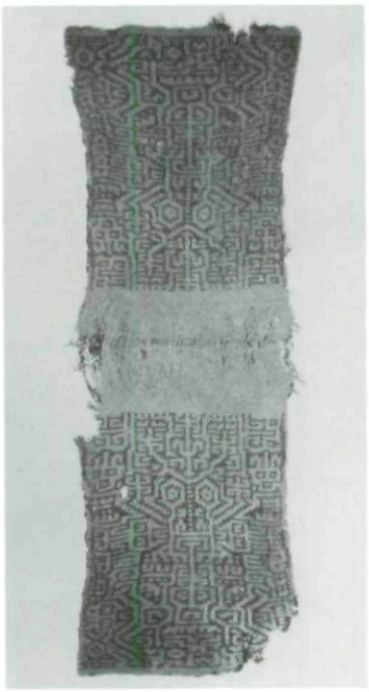

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Fig. 7. (A) and (B) Both faces of an unfinished tassel; the reflective halves of the fabric are joined by unworked warps indicating the technique was a reciprocal; the other face of the fabric has a complete color inversion due to the complementary nature of interchanging color layers; courtesy of Nobuko Kajitani and the Ohara Gallery of Art, Kobe, Japan, P 143; photo by Kojiro Tanaka

identified in complete fabrics by the presence of a holdline or unworked terminal area that joins two sections of fabric that are in complete reflective symmetry in structure, design, and even mistakes.[18] In complete tassels, the unworked terminal area is hidden by the cover of cross-knit looping.

The technique of sprang has a significant presence in ancient Peru, with the earliest documented piece coming from the Isla level at Cerrillos, Ica Valley, and dating to Early Horizon 7, approximately 700 B.C.[19] It is an undecorated narrow band with a structure of interlinking and oblique interlacing. Judging from the extant fabrics, it appears that the technique of sprang was most favored in Peru between Early Horizon 9 and Middle Horizon 1B, approximately 600 B.C. to A.D. 700, in the Paracas and Nasca styles. During this time span the fabrics are often large, always competently made, and frequently have elaborate imagery. Each of the structures has a fairly circumscribed set of uses, with interlinking preferred for headdresses (either turbans or hoods) and oblique interlacing generally limited to bags, belts, and narrow bands. Oblique intertwining is used in the most spectacular sprang fabrics: turbans and large shrouds with figurative or geometric designs and, of course, the highly patterned tassels described in this paper. The tassels appear to be the culmination of the sprang technique since they are both the most complex fabrics and the final ones to be made in this technique.[20]

A brief look at some of the simpler versions of oblique intertwined sprang[21] gives some insight into how the tassels may have been worked. The sparseness of excavation information rules out arranging the variants of oblique intertwining in a strict chronology, yet it is possible to see precursors of the tassel structure in the single layer shrouds and turbans, some of which are earlier than the tassels.[22] The basic structure of oblique intertwining is found in many fragments but always teamed with a second structure to give a contrast in transparency for the designs. Most often, the fabrics combine the basic structure with twisted pairs (Fig. 8). In the basic structure, intersecting pairs enclose one element of the other pair before

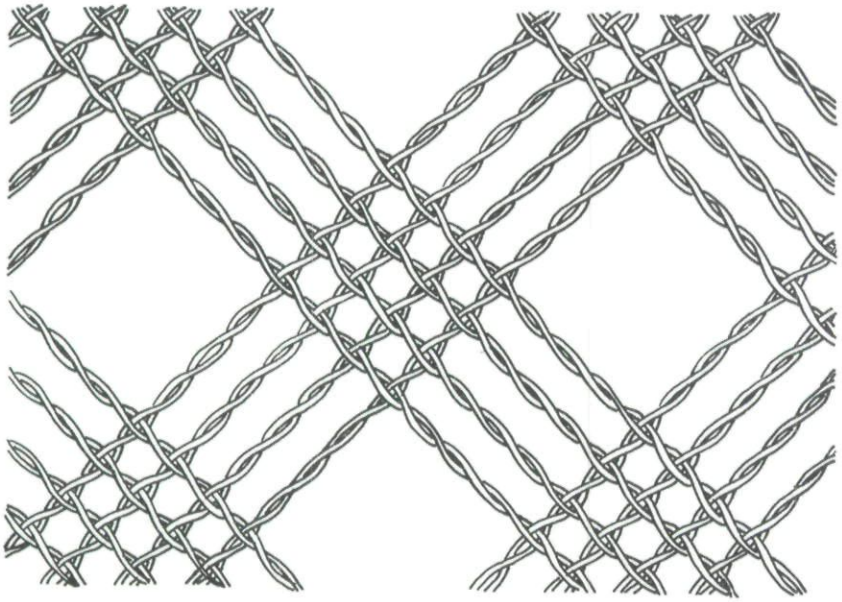
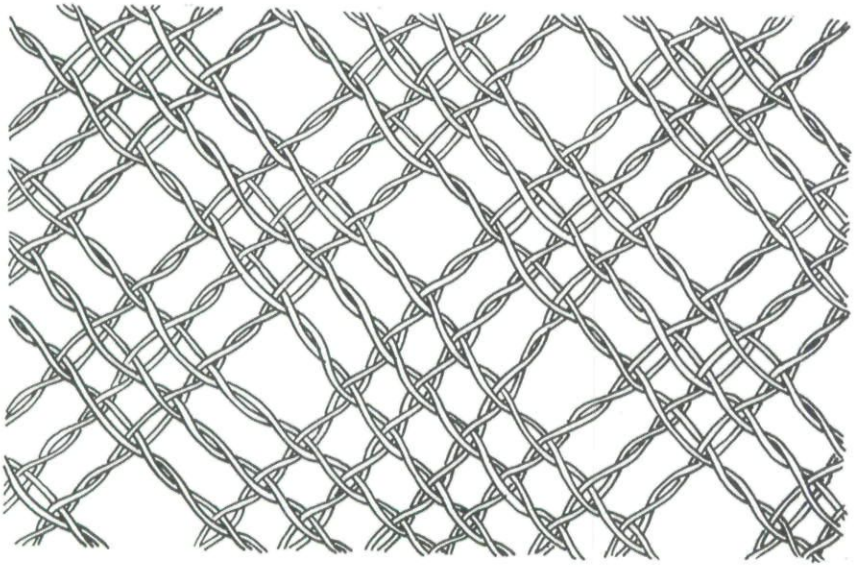


Fig. 8. The most common type of oblique intertwined fabric contrasts the basic intertwined structure with more transparent areas of twisted pairs; all drawings by the author

twisting with their partners. Other fabrics have variant structures, like Fig. 9, where some pairs enclose one element of more than one intersecting pair before twisting with their partners. The tassel structure relates more closely to the latter variant.

An unfinished sprang warp (Lowie Museum, 16-10153, Changuillo, Ingenio Valley) gives some insight into the process. The single layer warp has a few inches of oblique intertwining combined with twisted pairs at each end, and its ends are bunched and tightly wrapped by cotton cords. Like a weaving warp, the sprang warp is continuous and there are heading cords in the first sheds at each end. It is probable that it was mounted like a weaving warp as well, by lashing a loom bar and the first heading cord together with a separate string. The cotton cords now bunching the ends may have been the lashing cords. Removing the loom bars before burying the unfinished fabric may have been a practical measure that saved the tools for the next cloth or the next generation. Even today a villager will rarely part with the smooth, patinated bars and swords because they are heirlooms and because good wood is scarce. As with weaving looms, the sprang warp and loom bars could have been body-tensioned, staked out or lashed to a semi-vertical framework. Because the elements move on oblique and spiraling pathways, there is a lot of warp take-up which suggests a body-tensioned system would work well, at least for shorter warps.

Fig. 9. This variant structure of oblique intertwining occurs on two large shrouds in the Museo Nacional de Antropología y Arqueología, Lima, 06005 and 02293



In the unfinished example, the fabric fells, or working edges, are horizontal, which indicates that even though the elements move obliquely in the fabric the intertwining proceeds in horizontal rows. A single ancillary cord, lying in the final shed with alternate threads raised and lowered, preserves the last interworkings in each half. This temporary cord shows that the maker worked from a warp separated by a shed.

Peter Collingwood has reconstructed the finger movements for doing oblique intertwining that is in harmony with the observable features of the unfinished warp.[23] In Collingwood's method, adjacent pairs are interworked from an open shed that has alternate threads raised and lowered. With the left hand in the open shed, the first two pairs at the right edge intersect when the lower thread of the second pair is pulled to the right through the open shed of the first pair and the upper thread of the second pair is pulled to the right above the first pair. The intertwining is made when a half twist is given to both of the intersecting pairs. This is a fluid movement of raising the lower thread and dropping the upper thread of each pair after the intersection. These movements are repeated across the warp, building the fabric up in horizontal rows at both ends of the warp. Subsequent rows off-set the intersections by splitting and recombining the groups of four.

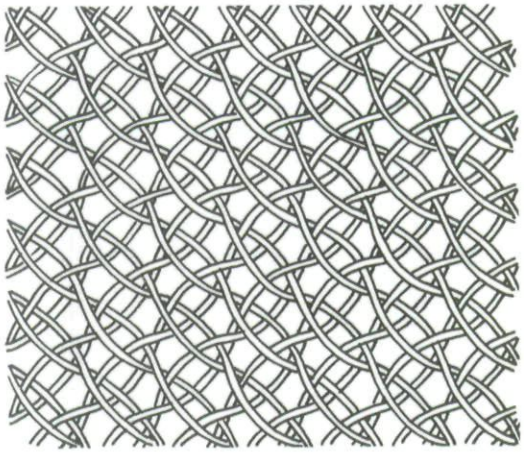


Fig. 10. The variant structure of oblique intertwining used in the tassels

The oblique intertwined structure of the tassels differs from the basic structure in that each pair of obliquely moving elements encloses one element of *two* intersecting pairs before twisting with its partner (Fig. 10). In terms of technique, this means that only one pair is given a half twist after the intersections in one row, and the pairs on the other diagonal are given the half twist in alternate rows.

The tassel structure is further elaborated by working two differently colored layers simultaneously. The colors move from face to face of the fabric to make the image and its outline. Looking at the wider tradition of double-faced woven fabrics from Peru gives some insight into the warp arrangement that could have been used for the tassels. The examination of ancient warp selvedges indicates that the warping for woven fabrics with color inversions on the two faces was done at the same time. The warps of both colors lie together in an alternating sequence on the same heading cords. Only later would they have been separated by shedding devices for weaving the fabric. It is reasonable to suppose that warping for the two interchanging layers of intertwined sprang was done in a similar way.

In the tassel intertwining, four threads of one color interwork. Doing this structure on a warp that alternates color by pairs requires a special maneuver of reaching across an intervening pair of the other color to bring the four threads together. The four threads of the second color, or back layer, are then intertwined (Fig. 11).[24] Alternately intertwining the threads of one color in front of any intervening threads and the threads of the other color behind any intervening threads produces front and back layers as well as the reflected layers at the other end of the sprang warp. After the initial row, the unworked warps alternate in color by fours (Fig. 12). As subsequent rows use the alternate pairing principle to split and regroup threads of the same color, the same maneuver of reaching across intervening pairs is used in all rows. The layers are slightly off-set because one color is worked before (i.e., to the right of) the other. Once established, the same color is always worked first, whether it is in the front or back layer.

Although the design panels of the tassels appear complicated, there are only two variations on the structure in Fig. 12 used to produce the patterning. One is changing the color by exchanging layers and the other is linking along vertical color boundaries.

Color changes are made in the process of making a row of intertwining. To bring the color of the bottom layer up, the intertwining is made in front of any intervening threads of the other color. The other color moves to the lower layer by

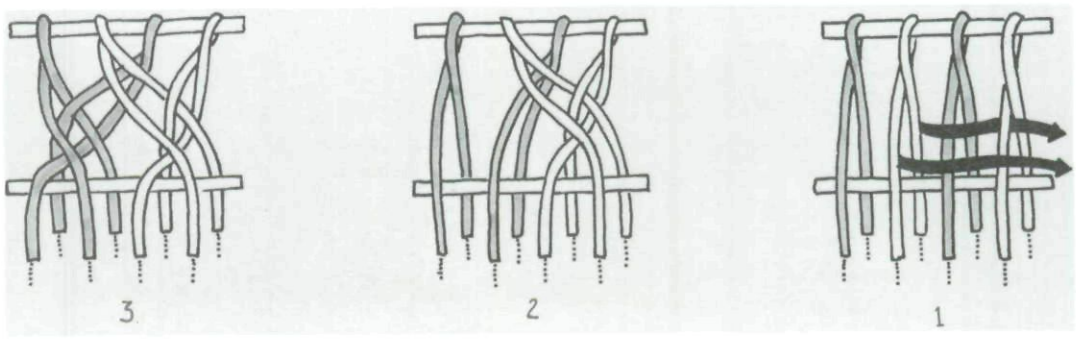


Fig. 11. The first movements in working two color layers from a warp that alternates color pairs

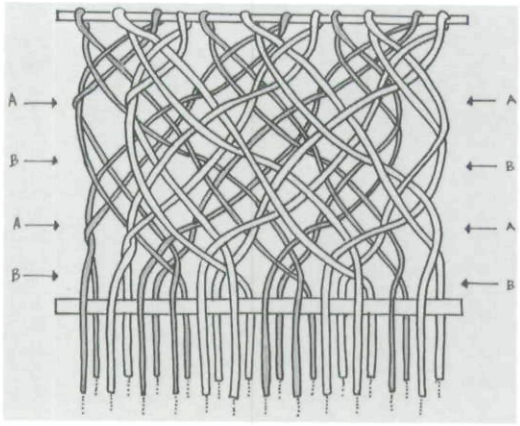


Fig. 12. Diagram of one end of a sprang warp with the two-layer tassel structure worked for four rows; the layers are slightly off-set and the shed stick at the bottom preserves the last row of intertwining; the arrows marked A indicate the rows on which the pairs on the Z diagonal are given a half twist; the arrows marked B indicate the rows on which the pairs on the S diagonal are given a half twist

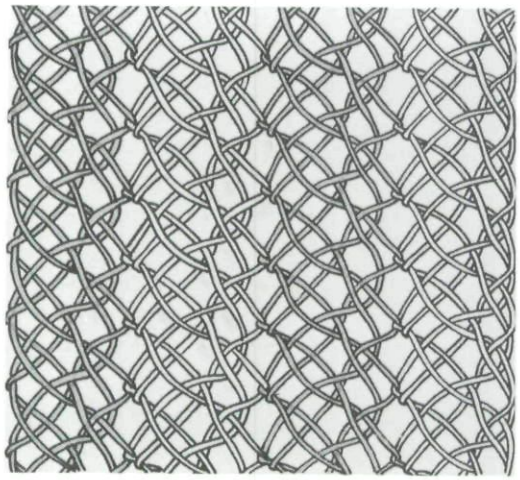
making its intertwining behind any intervening threads. When there is an exchange of layers, one group of four threads is lowered for every group of differently colored threads that is raised. Maintaining this complementary relationship between adjacent foursomes of different colors produces the inversion of color on the lower layer. The exchanging of groups of four threads between the layers is repeated two times to begin narrow vertical color areas, since a minimum of eight elements in each layer is necessary to work the structure. For wider color areas, the exchange operation is repeated as many times as necessary, but in multiples of two. By sticking to the multiples, a modular format is imposed on the two color design. Even diagonal color areas are built on the modular system by stepping the color exchange over regularly as the intertwining proceeds. The modular size in the other direction is based on two rows of intertwining.

Vertical color boundaries require another manipulation to join up with adjacent color areas and avoid slits. One thread of the pair at the boundary, the lower one, makes an elbowlike link with one thread of the pair at the adjacent boundary. Figure 13A diagrams the linking at the vertical color boundaries in one layer only, while Fig. 13B shows a detail of a tassel surface with vertical color areas. Element pairs move on short diagonal paths within vertical color areas. The link with the adjacent color area is the point at which the pair reverses onto the other diagonal.

The tassel structure with interchanges of color layers is shown in Fig. 14. The top half of the diagram has three horizontal color areas (A B A); the bottom half of the diagram shows three vertical color areas (A B A), with linking along color boundaries. The photograph in Fig. 15 shows both layers of a sample sprang warp with alternating color areas being worked in the tassel structure. All color areas in the design panels are produced by combining the horizontal and vertical color areas.

The design panel of most tassels is flanked above and below by a narrow border of oblique interlacing. At the bottom flared edge, elements pass obliquely over and under two or more elements and the layers do not interconnect in this area. At the top edge of the design panel, two to four elements obliquely interlace as groups, again in separate layers. There is some variation in the borders, including structure, number of elements in a working end, the length of the float, and the

A



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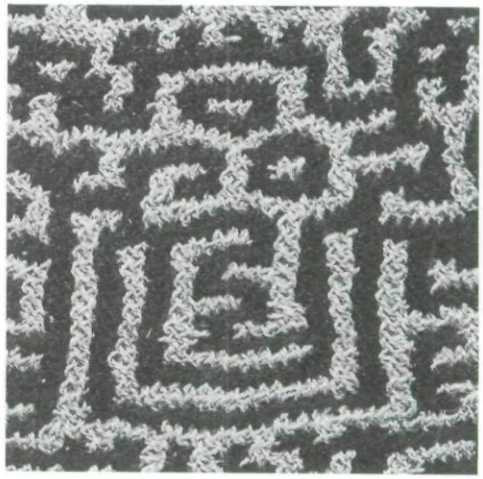

Fig. 13. (A) Diagram of one layer of the tassel structure showing the linking at vertical color boundaries; (B) close-up of a tassel showing the color areas and structure; Museum of Mankind, 1914 7-31 51, courtesy of the Trustees of the British Museum

Fig. 14. Diagram of the interchanging layers of the tassel structure with horizontal color areas in the top half (A B A) and vertical color areas in the bottom half (A B A)

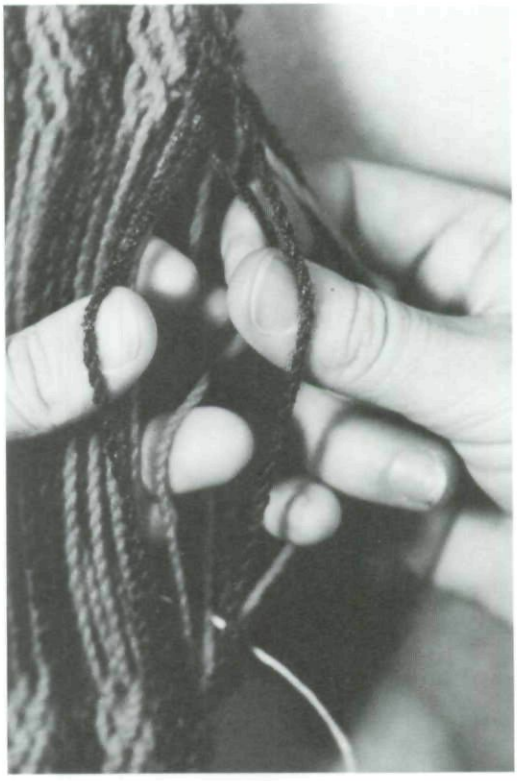

Fig. 15. Sample warp of the tassel variant of oblique intertwining being worked on two interchanging layers; photo by Alan R. Sawyer

direction of the twill ridges, but all the variants can be worked from the same warp arrangement suggested for the intertwined design panels.

Above the top border is a separately worked section of cross-knit looping which covers the unworked elements of the terminal area. Cross-knit looping is a single-element needle technique with a "crossed," or closed, looped structure. As in cross-knit looped fabrics from earlier Nasca phases, many colors are carried along underneath and brought out according to the requirements of the design.[25] A few tassels have woven warp-covers, with the images worked in supplementary wefts or embroidery.

The description so far applies to a large, fairly homogeneous group of tassels. Some of the minor variations have been mentioned, but the most astounding variation in this group is the example of oblique intertwining on four interconnected layers exhibited by a pair of tassels in the Museé de l'Homme.[26] Two interchanging color layers work together as figure and outline, and the other two interchanging layers stay together as well. At two points only do the bottom two layers move to the top and vice versa. Because the color layers do not move independently but always with their paired color, it would be possible to work two layers in the ordinary manner up to the point of interchange, then turn the loom over to work the other two layers up to the same point. The interchange would be a tedious matter of manually raising the threads of the bottom two layers between the threads of the upper two layers, but it would only have to be done twice in the process of making the pair of tassels. Unlike the previously described tassels, this pair was not constructed by folding the sprang warp. Rather, each tassel is one half of the sprang warp, albeit four layers thick.

A small group of tassels with a different appearance (Fig. 16) relates to the seemingly standard category. The images are much simpler, being confined to stripes and hooks. The structure is an openwork variety of oblique intertwining done on two interchanging layers. In this structure, all threads of both layers move on continuous diagonals from one edge of

Fig. 16. Tassel with an openwork variant of oblique intertwining on two interchanging layers; courtesy of Nobuko Kajitani and the Ohara Gallery of Art, Kobe, Japan, No. 0355; photo by Kojiro Tanaka

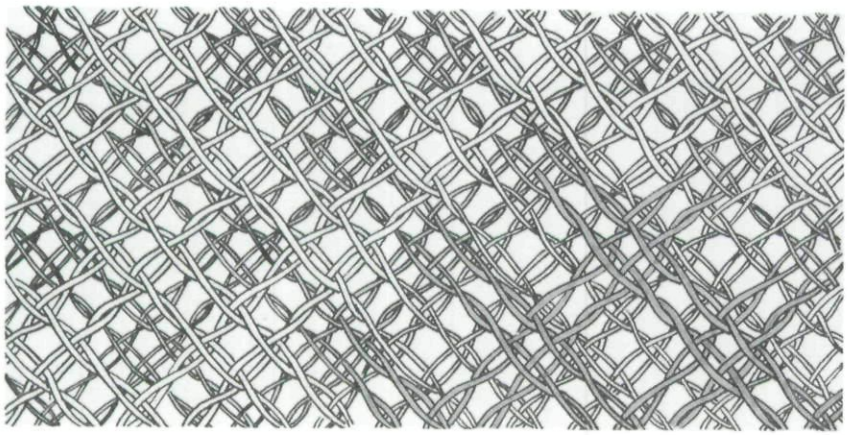

Fig. 17. Diagram of the variant of oblique intertwining used in the Fig. 16 tassel; the layers interchange to make a triangular shape of contrasting color in the lower right section of the diagram

the tassel to the other, even when they exchange position (Fig. 17). As this structure is quite similar to some of the openwork variants of the single layer shrouds, such as Fig. 9, it is a possibility that these tassels are technically transitional between the single layer examples and the more elaborately patterned tassels. Whether they are chronologically earlier than the highly patterned tassels, or a regional variant, can only be determined archaeologically.

Nine of the tassels located are partially or wholly woven and relate to the others in terms of shape, finish, and the use of two interchanging layers.[27] It is tempting to see them as the final expressions of the bell-shaped tassel. The woven structures in these tassels have more in common with the warp-patterned Middle Horizon fabrics[28] than they do with earlier Nasca fabrics. However, without archaeological data, the chronological placement of these tassels remains conjectural.

The reconstruction of the technique of the largest group of tassels, while hypothetical to some degree, does more than simply present one of a number of ways to replicate the structures. It relies on the evidence of the reflective halves, joined by the unworked warps, and the horizontal fell in the terminal areas (Fig. 7A, B). The reconstructed technique is consistent with an orderly production of all the structures found in the sprang tassels. It also takes into account the organizational patterns in the wider tradition of fabric making and the evolution of oblique intertwining and the technique of sprang in ancient Peru. There is an elegant orderliness to the reconstructured technique that befits the highly developed tradition of fabric making in Peru. In a single horizontal row, inverted designs on two layers are produced by alternately working threads of different color; the reciprocal half at the other end of the sprang warp, also two layers, is produced simultaneously. In this technique four fabric faces, repeating the same image but differing by reflection and inversion (Fig. 7), emerge under the fingers.

Ordering Principles

The symmetry and numerical regularity of the structure, as well as the modular format of the images and the inversion of figure and outline in the tassels, can all be accounted for in technical terms. In the reconstructed technique, they have been shown to be the natural products of the element arrangement and orderly interworking of the elements. Yet there is something not at all natural, but quite idiosyncratic, in the highly specialized and complex structure that leaves nagging questions. Why did the ancient Peruvians develop such excruciatingly complicated structures and techniques? Why didn't they simply paint or embroider the images on a plain cloth if it was only the images that were important?

Part of the answer may be that the structure and technique of complex textiles were also important. Provocative parallels can be drawn between the ordering principles of the structure and technique

and those of two-dimensional design in ancient Peruvian art.

The modular basis of the tassel images on multiples of eight threads and two rows has an analogue in modular layout of planar designs. The rows and columns, the diagonal bands and diamond grids organize space into regular units while the making of fabrics builds up space by the regular interworking of elements in rectilinear or oblique grids. The overwhelming repetition of field patterns is matched by the elemental repetition and the row-by-row construction of a fabric. The orientation variations between components of gridded designs have symmetrical relationships like the elements of fabric structures. Bifold rotation, the symmetry of the twining pairs in the tassel structure, is common in planar patterns based on stepped frets and interlocked serpents such as those on Nasca ceramics.[29] In some Late Nasca textiles, discrete figures relate diagonally to each other in bifold rotational symmetry[30] as do the elements in the obliquely twining pairs. Four-fold rotation, the symmetry of the intertwined crossing of pairs, is not so common in designs, yet it does appear seven times in its swastikalike form on a single Late Nasca textile.[31] In another article, I related symmetries in serpentine field patterns to fabric structures with corresponding symmetries. I traced the patterns back to more naturalistic representations of fabric structures in the Early Horizon, making it clear that the relationship is more than a chance sharing of a symmetry.[32] Modules and rotational symmetry are ordering principles inherent in the structures of some complex fabrics, and they are also basic to the format of many field patterns.

Reflective symmetry, seen in the reciprocal halves of sprang fabrics like the tassels, appears on many levels in planar designs. Frontal and dorsal viewpoints (Figs. 1 and 5) reflect figures bilaterally while other images are made composite by reflection as, for example, in the double headed zoomorphs and the four-part rays and volutes of the Fig. 1 tassel. The repetition of images can use reflection along one or both axes, like the Huari style tunics, classified as Type II Composite by Alan Sawyer, which reflect on both axes.[33] While the structure of sprang fabrics reflects along one transverse axis, like the designs on tunics[34] and the famous ceremonial cloth in the Brooklyn Museum,[35] other forms of reciprocal braiding reflect along one or more longitudinal axes.[36] Reflections within images and between images in field patterns have analogues in the reciprocal fabric-making techniques like sprang which mirror their structure transversely or longitudinally.

The inversion of positive and negative space is a common attribute of Peruvian designs, most simply illustrated in the brown and white Chancay double cloths. The inversion arises naturally in techniques, like that of the tassels, where complementary color sets are used in two-layer or double-faced fabrics. When threads of one color are brought to the surface, their partners in the complementary color set are lowered, producing a complete color inversion between the two faces. In two-color field patterns, the image and its inversion frequently alternate, as if both structural faces of a double-faced textile were being made simultaneously visible.[37] Rotations, or alternations of more than two colors, in field patterns[38] also have structural analogues in complex, multilayered textiles like the tassels with four interchanging layers.[39] The inversion of positive and negative space and the rotation of two or more colors are examples of ordering present in the structure and technique of complex fabrics and in the format of some planar patterns.

In the tassels, there is an emphatic numerical ordering based on multiples, particularly pairs. The tassels are joined together in pairs, the halves of the sprang warp are paired and the elements work as pairs. In the intertwined crossings, pairs of pairs intersect and alternate pairings split and regroup elements. The modular width of color areas is based on multiples of eight which, in turn, are multiples of the twining pairs. In planar design, profile figures rarely appear singly but are arranged instead as flanking pairs or gridded multiples, as in the stone monuments of Tiahuanaco. Singular images, on the other hand, are usually frontal where they are, in a sense, already paired by the reflective symmetry of their halves. Band and field patterns based on reflective or

rotational symmetry depend on the pairing and multiplying of motifs that have a complementary fit. Textiles, which bear the majority of extensive field patterns, are generally composed of pairs of loom widths which are put together in various ways to continue, reflect, or rotate the patterns in the two halves. Other layouts, like corner-ornamented cloths or bordered cloths generally repeat the feature in pairs or multiples.

Alternation is closely tied to ordering by pairs and multiples. In the tassels, work proceeds from a shed where alternate threads are raised and lowered. Groups of threads from each color set alternate in the warp set-up and intertwinings are alternately made in one color layer and then the other. In field patterns, the most frequent format is a checkerboard arrangement which regularly alternates at least two, but often more, colors or motifs. Oblique grids of triangles, diamonds, or zigzags also alternate a minimum of two motifs, colors, textures, or transparencies.

Conclusions

The ordering principles outlined are overlapping and not mutually exclusive. In field patterns, they appear within images or between images and in many combinations. In textile structures and techniques, they can appear as relationships between elements, sets, layers, sections, or loom widths. Some field patterns, particularly those based on interlocked stepped frets, nested diamonds, and squares, can contain all the ordering principles discussed here, just as some complex fabrics, like the tassels, can contain most of them in their structure and technique. Unusually complex textiles like the tassels may have been developed as a synthesis or a compendium of ordering principles. A similar purpose could account for the popularity and longevity of field patterns based on simple units like stepped frets, nested diamonds, and squares: they are the most succinct representation of many ordering principles.

The sharing of ordering principles in the structure and technique of complex fabrics like the tassels and in planar designs does not necessarily imply that one derives from the other. It could equally be argued that they developed side by side or that both derived from another source.[40] The point is simply that because the same ordering principles are used in two very different, man-made systems, there is a much greater likelihood that the ordering was intentional and meaningful. The general avoidance of alternatives, like three- and five-part divisions, polygonal grids with more than two axes, and field patterns based on three- or six-fold rotation, underlines the active nature of the ordering choices exhibited in both systems.[41] In the case of ancient Peruvian planar designs and fabric structures, it appears that not only the images but the formal arrangement or ordering of images and of threads is meaningful.

Ascher and Ascher have chosen the phrase "Inca insistence" to describe the patterning or emphatic repetition that resonates in the art, artifacts, and cultural institutions of the Inca Empire, shaping diverse objects and activities in accordance with the same principles.[42] Although there is much less comparative information in the prehistorical cultures on which to discern an "insistence," the ordering of both field patterns and fabric structures and techniques by the same principles is at least emphatic, if not insistent. The shared order of the two systems gives some insight into a preferred format and some basis for the expectation that aspects of a culture which now cannot be reconstructed may also have shared a similar format.

The ordering principles of modular grids and bands, reflection, bi-fold and four-fold rotation, repetition, inversion, alternation, and the use of pairs and multiples of pairs appear to change little through time, with each group selecting, elaborating, and combining them with its own imagery to produce a distinctive style. Even today, village weaving in the Andes repeats some structures, techniques, and field patterns that are millenia old. This continuity may rest on an adherence to a common set of ordering principles rather than the specific transmission of motifs and techniques.

The impetus for developing complex fabrics like the tassels may have arisen from their unique possibilities for expressing order and interrelationships in a

relatively small and portable object. The tassels were made toward the end of a long and splendid fabric tradition as the Nasca people were falling more and more under the sway of the ascendent Huari. Perhaps the extraordinary structural complexity of the tassels represents a final effort to maintain some cultural integrity on a subterranean level, while increasingly they depicted the images of the conquerors. Huari dominion is established on the coast in Middle Horizon 2, and intertwined sprang and other techniques favored by the Nasca people are supplanted by different ways of making fabric shortly after the epoch of the tassels.

Acknowledgments

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Notes

1. Walter Lehmann and Heinrich Ubbelohde-Doering, *The Art of Old Peru* (Tubingen: Verlag Ernst Wasmuth, 1924), pl. 1; Raoul d'Harcourt, *Textiles of Ancient Peru and Their Techniques*, trans. Sadie Brown, ed. Grace G. Denny and Carolyn M. Osborne (Seattle: University of Washington Press, 1962), pls. 57, 58; Lila M. O'Neale and A. L. Kroeber, *Textile Periods in Ancient Peru*, University of California Publications in American Archaeology and Ethnology, vol. 28, no. 2 (Berkeley, 1930), pl. 21; Junius B. Bird, "Technology and Art in Peruvian Textiles," in *Technique and Personality* by Margaret Mead, Junius Bird, and Hans Himmelheber, The Museum of Primitive Art Lecture Series, no. 3 (New York, 1963), pl. 10; Kanegafuchi Boseki Kabushiki Kaisha, *Textiles of Pre-Inca, from Burying Grounds in Peru*, vols. 1 and 8 (Osaka: Kanegafuchi Spinning Company, 1956), vol. 1, no. 10 and vol. 8, no. 76; Samuel K. Lothrop, W. F. Foshag, and Joy Mahler, *Pre-Columbian Art* (New York: Phaidon Press, 1957), pl. CXLII; Ann Pollard Rowe, "After Emery: Further Considerations of Fabric Classification and Terminology," *The Textile Museum Journal*, 23 (1984): 53–71, fig. 1; idem, *A Heritage of Color: Textile Traditions of the South Coast of Peru*, gallery guide (Washington, D.C.: The Textile Museum, 1973), no. 38; Peter Collingwood, *The Techniques of Sprang* (London: Faber & Faber, 1974), pl. 43; Nobuko Kajitani, "Andesu no Senshoku" (Textiles of the Andes), *Senshoku no Bi* (Textile Art), 20 (Autumn, 1982): 9–99, fig. 61; Mary Elizabeth King, "Sprang in the Paracas Period of Peru," in *In Celebration of the Curious Mind: A Festschrift to Honor Anne Blinks on Her 80th Birthday*, ed. Nora Rogers and Martha Stanley (Loveland, Col.: Interweave Press, 1983), photo 4.
2. Mary Frame, "Ancient Peruvian Sprang Fabrics" (Master's thesis, Fine Arts, University of British Columbia, 1982).
3. The terminology for structure and technique derives from Irene Emery, *The Primary Structures of Fabrics: An Illustrated Classification* (Washington, D.C.: The Textile Museum, 1966) and Collingwood, *The Techniques of Sprang*, with more recent consideration by Rowe, "After Emery," and by me.
4. See also Kajitani, "Andesu no Senshoku," fig. 61, and Collingwood, *The Techniques of Sprang*, pl. 43.
5. Raoul d'Harcourt, *Les textiles anciens du Pérou et leurs techniques* (Paris: Les Editions d'Art et d'Histoire, 1934), 82–84.
6. Frame, "Ancient Peruvian Sprang Fabrics," 128–216.
7. O'Neale and Kroeber, *Textile Periods*, pl. 21 and pp. 53, 54.
8. Harcourt, *Textiles of Ancient Peru*, pls. 57, 58, and p. 161.
9. O'Neale and Kroeber, *Textile Periods*, pl. 16,

Trancas, and pl. 19. Cacatilla.

10. Ceramics are the basis of the chronology devised by archaeologists for relative dating purposes. Peruvian prehistory on the South Coast has been divided into three Horizons (Early, ca. 1600–400 B.C.; Middle, ca. A.D. 600–950, and Late, A.D. 1475–1534), which were times of some cultural unity. The two Intermediate Periods (Early, ca. 400 B.C.–A.D. 600 and Late, ca. A.D. 950–1476) were times of regional diversity. The Nasca style is the regional style of the South Coast in the Early Intermediate period and it is divided into eight phases (ca. 400 B.C.–A.D. 600). The final or ninth phase, referred to as Late Nasca, continues into the first epoch of the Middle Horizon (ca. A.D. 600–700) where it is under considerable influence from the highland Huari.
11. Ann Pollard Rowe, in "A Late Nasca Derived Textile with Tapestry Medallions," *Bulletin of the Detroit Institute of Arts*, vol. 57, no. 3, pp. 114–123, has provided a sketch of Late Nasca style textiles from Epoch 1B of the Middle Horizon (ca. A.D. 650–700), which includes some tassels, by relating the iconography to that on ceramics. She cautions that some revision may be necessary if more archaeological information becomes available because the textiles have not been scientifically excavated and because very few textiles have been assigned stylistically to the preceding phases.
12. Although the entire Nasca sequence has not been published in detail, Richard Roark, in "From Monumental to Proliferous in Nasca Pottery," *Ñawpa Pacha* 3(1965): 1–92, describes the major shifts in phases 5 and 6 of the Nasca style. Donald A. Proulx, "Local Differences and Time Differences in Nasca Pottery," *University of California Publications in Anthropology* 5 (1968), has published the evidence for phases 3 and 4, and Dorothy Menzel, "Style and Time in the Middle Horizon," *Ñawpa Pacha* 2 (1964): 1–105, has covered Nasca 9B.
13. O'Neale and Kroeber, *Textile Periods* and O'Neale, "Textiles of the Early Nazca Period," *Anthropology Memoirs* 2, no. 3, Field Museum of Natural History, Chicago.
14. Alan R. Sawyer, "Paracas and Nazca Iconography," in Samuel K. Lothrop et al., *Essays in Pre-Columbian Art and Archaeology* (Cambridge: Harvard University Press, 1961), 269–298, fig. 11; Roark, "Nasca Pottery," figs. 37, 62; Alan Lapiner, *Pre-Columbian Art of South America* (New York: Harry N. Abrams, 1976), fig. 504; and Elizabeth Farkass Wolfe, "The Spotted Cat and the Horrible Bird; Stylistic Change in Nasca 1–5 Ceramic Decoration," *Nawpa Pacha* 19 (1981): 1–62, fig. 184.
15. The interpretation of the cultural interaction between the coastal Nasca and the highland Huari derives from Menzel, "Style and Time" and secondarily from Rowe, "A Late Nasca Derived Textile."
16. For double-plaiting see Harcourt, *Textiles of Ancient Peru* and O'Neale, "Textiles of the Early Nazca Period," and "Textile Periods in Ancient Peru: II, Paracas Cavernas and the Grand Necropolis," *University of California Publications in American Archaeology and Ethnology*, vol. 39, no. 2, for twine-plaiting. Rowe, "After Emery," 53–56 and nn. 2–28, has recently reviewed the terminology problems relating to this reciprocal technique and suggests the retention of the term "sprang," which has been in general use in recent years.
17. Frame, "Ancient Peruvian Sprang Fabrics."
18. Collingwood, *The Techniques of Sprang*, 273, 274.
19. Dwight T. Wallace, "Cerrillos, an Early Paracas Site in Ica, Peru," *American Antiquity* 27(1962): 303–314, and Frame, "Ancient Peruvian Sprang Fabrics," 26–29.
20. The temporal presence of the sprang technique is summarized by structure and garment type, based on the currently known sample in ibid., Table II, p. 221.
21. Oblique intertwined fabrics that are too fragmentary to have evidence of the sprang technique are included in the discussion because it is assumed, from the number of fabrics with direct evidence, that the specialized structures of oblique intertwining were always made in the sprang technique.
22. The drawing on p. 126 of Julio C. Tello and Toribio Mejía Xesspe, *Paracas, Segunda Parte: Cavernas y Necropolis* (Universidad Nacional Mayor de San Marcos and Institute of Andean Research), appears to be a stylized rendering of oblique intertwining. See also pl. 7 of O'Neale and Kroeber, *Textile Periods*.
23. Collingwood, *The Techniques of Sprang*, 203–205.
24. In his almost exhaustive book, Collingwood, op. cit., devises techniques for some variations with no known historical occurrence. Although he does not analyze or replicate the tassel structure, one of his inventions, for double-layer interlinked sprang (pp. 167–183), provided the insight into alternately working both color layers of the tassels in the same row, which greatly facilitates the large number of color changes in the tassels.
25. O'Neale, "Textiles of the Early Nazca Period," pl. 53.
26. Harcourt, *Textiles of Ancient Peru*, pl. 58.
27. See Frame, "Ancient Peruvian Sprang Fabrics," fig. 96, pp. 99–104; Lothrop, Foshag, and Mahler, *Pre-Columbian Art*, 346; and Adele Cahlander with Suzanne Baizerman, *Double Woven Treasures of Old Peru* (St. Paul, Minn.: Dos Tejedoras, 1985), pls. 14, 15.
28. Ann Pollard Rowe, *Warp-Patterned Weaves of the Andes* (Washington, D.C.: The Textile

Museum, 1977), figs. 70, 77, and 113.

29. Eduard Seler, "Die Buntbemalten Gefasse von Nazca," *Gesammelte Abhandlungen zur Amerikanischen Sprach und Altertunskunde*, 4 (Berlin: Behrend, 1923): 232.
30. Mary Elizabeth King, *Ancient Peruvian Textiles from the Collection of the Textile Museum, Washington, D.C.* (New York: The Museum of Primitive Art, 1965), no. 12.
31. Rowe, "A Late Nasca Derived Textile," fig. 1.
32. Mary Frame, "The Visual Images of Fabric Structures in Ancient Peruvian Art," in *The Junius B. Bird Conference on Andean Textiles, April 7th and 8th, 1984*, ed. Ann Pollard Rowe (Washington, D.C.: The Textile Museum, 1986), 47–80.
33. Alan R. Sawyer, "Tihuanaco Tapestry Design," *The Textile Museum Journal*, vol. 1, no. 2 (1963): pp. 27–38. See also idem, *Museum of Primitive Art Studies*, no. 3, 1963.
34. King, *Ancient Peruvian Textiles*, no. 4.
35. Harcourt, *Textiles of Ancient Peru*, pl. 88.
36. Noémi Speiser, *The Manual of Braiding*, (Basel, Switz., 1983), records three Peruvian examples of braiding that are reciprocal on the longitudinal axis and worked on looped ends (14.37–39). Since contributing to her book (14.38) prior to its publication, I have located more examples. Flat braids done in this technique are characteristically in almost reflective symmetry longitudinally. They deviate from perfect reflection just to one side of absolute center when one element floats over an extra element. This arises when shanks of the final loop-end element in each row interwork with each other. Variations on the technique can produce two perfectly mirrored but separate braids and braids with two or more interchanging layers.
37. Rowe, *Warp-Patterned Weaves*, figs. 70, 78, and 79.
38. Luis G. Lumbreras, "Arte precolombino: Primera parte, Arte textil y adornos," in *Colección Arte y Tesoros del Perú*, ed. Jose Antonio de Lavalle and Werner Lang (Lima: Banco ce Crédito del Perú, 1977), 172.
39. Harcourt, *Textiles of Ancient Peru*, pl. 58.
40. Just as it is generally assumed that Base 10 numeration derives finally from hands with ten digits, the ordering principles described might also ultimately derive from forms in nature, like the anatomy of animals and the morphology of plants.
41. Islamic tilework (Keith Critchlow, *Islamic Patterns: An Analytical and Cosmological Approach* [London: Thames and Hudson, 1976]), for instance, illustrates a distinctly different set of ordering principles underlying the field patterns.
42. Robert Ascher and Marcia Ascher, *Code of the Quipu* (Ann Arbor: University of Michigan Press, 1981), 37–58.